

# CCS-UNet: a cross-channel spatial attention model for accurate retinal vessel segmentation: supplement

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**Table S1. List of Variables.**

Symbol	Definition
$F$	Input feature map of the CCS module
$F_{mid}$	Feature map responsible for encoding horizontal and vertical spatial information
$F^H$	Spatial feature encoding along the vertical direction
$F^W$	Spatial feature encoding along the horizontal direction
$F_C$	The output feature map of the first branch of the CCS module
$F_S$	The output feature map of the second branch of the CCS module
$F_{out}$	The final output feature map of the CCS module
$F(i, j)$	$i, j$ are the indexes of height and width in the input feature map $F$ respectively
$F_C(i, j)$	$i, j$ are the indexes of height and width in the output feature map of the first branch of the CCS module
$F_S^{MP}$	The feature code obtained from the input feature map $F$ after maximum pooling in the channel direction
$F_S^{AP}$	The feature code obtained from the input feature map $F$ after averaging pooling in the channel direction
$G^H$	Attention weighting map along the vertical direction
$G^W$	Attention weighting map along the horizontal direction
$Z^H$	Coding feature map for aggregating features along the vertical direction
$Z^W$	Coding feature map for aggregating features along the horizontal direction
$Z_c^H(h)$	The mathematical representation $Z^H$ of of the $c$ -th channel at a given height $h$
$Z_c^W(w)$	The mathematical representation $Z^W$ of of the $c$ -th channel at a given width $w$
$X_c(h, i)$	Denotes the row vector of input features on a given channel $c$ and height $h$
$X_c(j, w)$	Denotes the column vector of input features on a given channel $c$ and width $w$
$M_S(\cdot)$	Operations used to obtain attention weight maps for cross-channel information